PATENT – Docket Number: 06310 USA

Remarks

Claim Amendments

Claim 1 has been amended to specify that the temporary supply of a back-up quantity of first gas takes place during the time taken for a vaporizer in a main back-up system to come fully on on-line. Support for this amendment can be found on page 4, lines 1 to 4 of the description as filed.

Further, Claim 1 has also been amended to specify that at least a portion of the vaporization duty required to vaporize the withdrawn liquefied first gas inventory is provided by heat inventory from the or at least one of said heat exchangers. Support for this amendment can be found in Claim 3 as filed.

Claim 3 has been cancelled as it is now redundant over amended Claim 1.

Claims 13 to 15 have been amended in the same way as Claim 1.

Claims 1, 4-7, 9 and 13-15 have been amended to change the British (to American) spellings of vaporize, vaporizer and vaporization. Claim 13 has been amended to correct the spelling of liquefied.

No other amendments have been made to the claims.

35 USC § 119(b) – Priority

In the Office Action, the Examiner indicated that a certified copy of the priority application (GB 0219415.7) has not been filed. Please see a copy of the attached postcard with the USPTO's stamp indicating that the certified copy of the priority application was in deed filed with

and received by the USPTO. Applicant requests the Examiner make a review of the file to determine whether another copy of the priority application needs to be filed.

35 USC § 102 – Novelty

In the Office Action, the Examiner rejected Claims 1-4, 8 and 11-13 under 35 USC 102(b) as being anticipated by Jahnke; Claims 1-4, 8, 9 and 11-13 under 35 USC 102(b) as being anticipated by Bernard et al '044 ("Bernard"); Claims 1-4, 8 and 11-13 under 35 USC 102(b) as being anticipated by Ekins et al ("Ekins"); Claims 1-4, 8 and 11-13 under 35 USC 102(b) as being anticipated by Corduan et al ("Corduan"); Claims 1-4, 8 and 11-13 under 35 USC 102(b) as being anticipated by Higginbotham et al '259 ("Higginbotham") and Claims 1-4, 8 and 11-13 under 35 USC 102(b) as being anticipated by Darredeau '482 ("Darredeau").

Jahnke, Ekins, Higginbotham, Bernard and Darredeau all disclose processes for cryogenic distillation of air which accommodate variations in oxygen demand.

Jahnke corresponds with WO-A-99/40304 which was cited in the search report issued in respect of the corresponding European patent application No. 03255052.7 and which has been acknowledged in the present application (see page 3, lines 10 to 22). Jahnke discloses a combined cryogenic air separation unit/integrated gasifier combined cycle power generation system and describes a method for operating the ASU to vary its power consumption to maximize net power production during peak demand periods while maintaining peak efficiency when the power generation system operates on varying power production. The oxygen production rate is maintained at a stable optimum level throughout the day and is not subject to significant fluctuations during changes in power plant operating conditions. Referring to Figure 1, in periods of off-peak power demand, excess liquid oxygen ("LOX") generated by the ASU may be stored in the bottom of the low pressure distillation column 6 (see column 5, lines 50 to 51) or transferred through line 13 to vessel 21 where it is stored until such time as it is needed during periods of high power demand in the integrated gasifier combined cycle system (see column 5, lines 51 to 56).

Ekins corresponds with US-A-5505052 which was also cited in the search report issued in respect of the corresponding European patent application. Ekins discloses a process for the cryogenic separation of air in which excess LOX may be stored in a storage vessel 20 during periods of low demand. LOX may be withdrawn from storage vessel 20, pumped in pump 19 to the required pressure and vaporized in the main heat exchanger 11 during periods of high demand.

Higginbotham discloses a process for the cryogenic distillation of air in which, during periods of low demand, excess LOX may be stored a storage vessel 66. During period of high demand, a stream 72 of LOX may be withdrawn from the storage vessel 66 and pumped in pump 74 to the required pressure and vaporized in the main heat exchanger 22 to produce gaseous oxygen.

Bernard is acknowledged in the present application (see page 3, lines 24 to 26) and discloses the use of a LOX storage tank 10 to store excess LOX which can be used to satisfy increases in oxygen demand.

Darredeau discloses a further process in which excess LOX, produced during periods of low oxygen demand is stored in storage vessel 10. LOX is removed from the storage vessel 10 and vaporized in the main heat exchanger 3 during periods of high oxygen demand.

None of Jahnke, Ekins, Higginbotham, Bernard or Darredeau even recognizes the problem of maintaining the supply of a first gas product during the time taken for a vaporizer of a main back-up system to come on-line, let alone discloses a solution to this problem. None of these references discloses vaporizing liquefied first gas inventory, taken from the cryogenic distillation system during the relevant time, and using heat inventory from the heat exchangers to vaporize the withdrawn liquefied first gas inventory, thereby providing a temporary back-up supply of first gas to maintain the first gas production level during the inherent delay before the

main back-up system becomes fully operational. Therefore, the process of amended Claims 1 and 13-15 is novel over these references.

Corduan discloses a cryogenic air separation process incorporating an emergency supply system. It is discloses (see column 2, lines 24 to 31) that, should an operating disturbance of the air separation system occur, (excess) liquid stored in a tank is pumped into an emergency evaporator and evaporated. The gaseous product obtained in the emergency evaporator can then be transported to the corresponding application sites in order to provide an emergency supply of gaseous product.

In the event that the proper operation of the system as depicted in Figure 1 of Corduan can no longer be maintained, for example in the event of a failure of a component to the air separation system, continued supply of oxygen and nitrogen is ensured by way of an emergency supply (see column 6, lines 14 to 25). The emergency supply will also be used if the demand for the gaseous product exceeds the production for a short time. For this purpose, liquid nitrogen is pumped by means of pump 18 from the tank 13 into a water bath evaporator 25 where it is evaporated. Analogously, by means of pumps 23a and 23b, liquid oxygen can be fed to the evaporators 26a and 26b where it is evaporated against ambient air or water.

As explained in the description (see page 2, lines 14 to 30), vaporizers in back-up supply systems cannot instantly attain their design vaporization capacities when called upon to operate. It appears to me that the water bath evaporator 25 and the evaporators 26a and 26b in Figure 1 of Corduan are examples of main back-up supply vaporizers and, thus, need time to cool down to a point where the cryogen may be vaporized at the necessary rate. This period of time may be up to 30 seconds within which time the process being fed by the ASU may have been affected by the reduction in pressure or flow of gaseous product thereto.

There is no disclosure of this problem in Corduan, let alone of vaporizing liquefied first gas inventory from the cryogenic distillation system using heat inventory from the heat exchangers of the ASU system in order to produce gaseous product and, thereby, maintain the

required level of production of the product in question during the critical time when the main back-up system comes on-line in the event of a sudden reduction in the level of production of gaseous product. The process of amended Claims 1 and 13 to 15 is therefore novel over Corduan.

35 USC § 103 - Obviousness

In the Office Action, the Examiner rejected Claims 5-7, 10 and 14-16 under 35 USC 103(a) as being unpatentable over Bernard or Higginbotham.

The problem addressed by the present invention is to produce a temporary supply of first gas from a cryogenic separation process during the time taken for a vaporizer of a main back-up supply system to come on-line (in the event of a sudden reduction in the level of production of the first gas) in order to maintain the required level of first gas supply during this time. The solution proposed by the present invention is to withdraw liquefied first gas inventory from the cryogenic distillation system and to vaporize said withdrawn inventory to product a back-up quantity of first gas. At least a portion of the vaporization duty required to vaporize the withdrawn liquid is provided by heat inventory from the or at least one of the heat exchangers of the cryogenic distillation system.

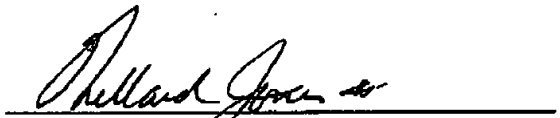
None of the cited references even acknowledges the problem. None of these references proposes any solution to the problem let alone a solution falling within the scope of the amended claims. Accordingly, there is no suggestion in any of the cited references that would have prompted the skilled person before the priority date of the present application to consider using heat inventory from the heat exchangers of the cryogenic distillation system to vaporize a portion of the liquefied first gas inventory stored in the distillation system to produce a temporary supply of first gas in order to maintain the level of production of first gas during the time it takes for a main back-up system to come on-line.

The process of Claims 1 and 13 to 15 is, therefore, not obvious over any of the cited references when considered alone or in any combination.

Conclusion

The process as defined in amended Claims 1 and 13 to 15 is both novel and non-obvious over the cited references. The process embodiments of Claims 2 to 12 and 16 are also novel and non-obvious by virtue of the dependency of these claims from amended Claims 1 and 13 to 15. The Examiner is therefore respectfully requested to reconsider his rejection of the Claims and to issue a notice of allowance.

Respectfully submitted,



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AIR PRODUCTS

PATENT APPLICATION

22151 U.S. PTO
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07/30/03

DOCKET NO: 06310 USA

EXPRESS MAIL LABEL NO: EL685810759US

DATE OF DEPOSIT: 30 July 2003

FIRST NAMED INVENTOR: Declan P. O'Connor

TITLE OF INVENTION: Process and Apparatus for Cryogenic Separation of Gases

The stamp of the U.S. Patent and Trademark Office Mail Room hereon indicates receipt of the following:

- ☒ Application Transmittal Form
  - ☒ Original Application
  - ☐ Divisional Application
  - ☐ Continuation-in-Part Application
  - ☐ Continuation Application
- ☐ Continued Prosecution Application (CPA) Form Containing Fee Transmittal (in duplicate)
- ☒ Patent Application
  - ☒ Specification: 15 pages
  - ☒ Drawings: 1 sheets
  - ☒ Claims: 16 Total
    4 Independent
- ☒ Declaration and Power of Attorney
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- ☒ Information Disclosure Statement (IDS)
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- ☐ Preliminary Amendment
- ☐ Letter

☒ Fee Transmittal Charging Deposit Account (in duplicate)

☒ Other Certified Copy of GB 0219415.7 and Statement under CFR 3.73(b)

Attorney Willard Jones II

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